

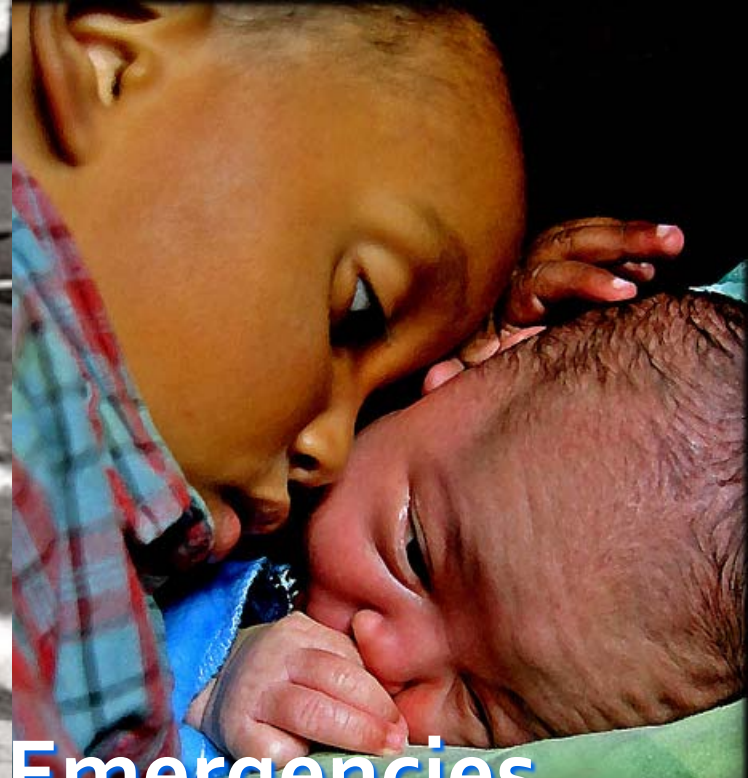
Pediatric Respiratory Emergencies



Ritu Malik, MD

Objectives

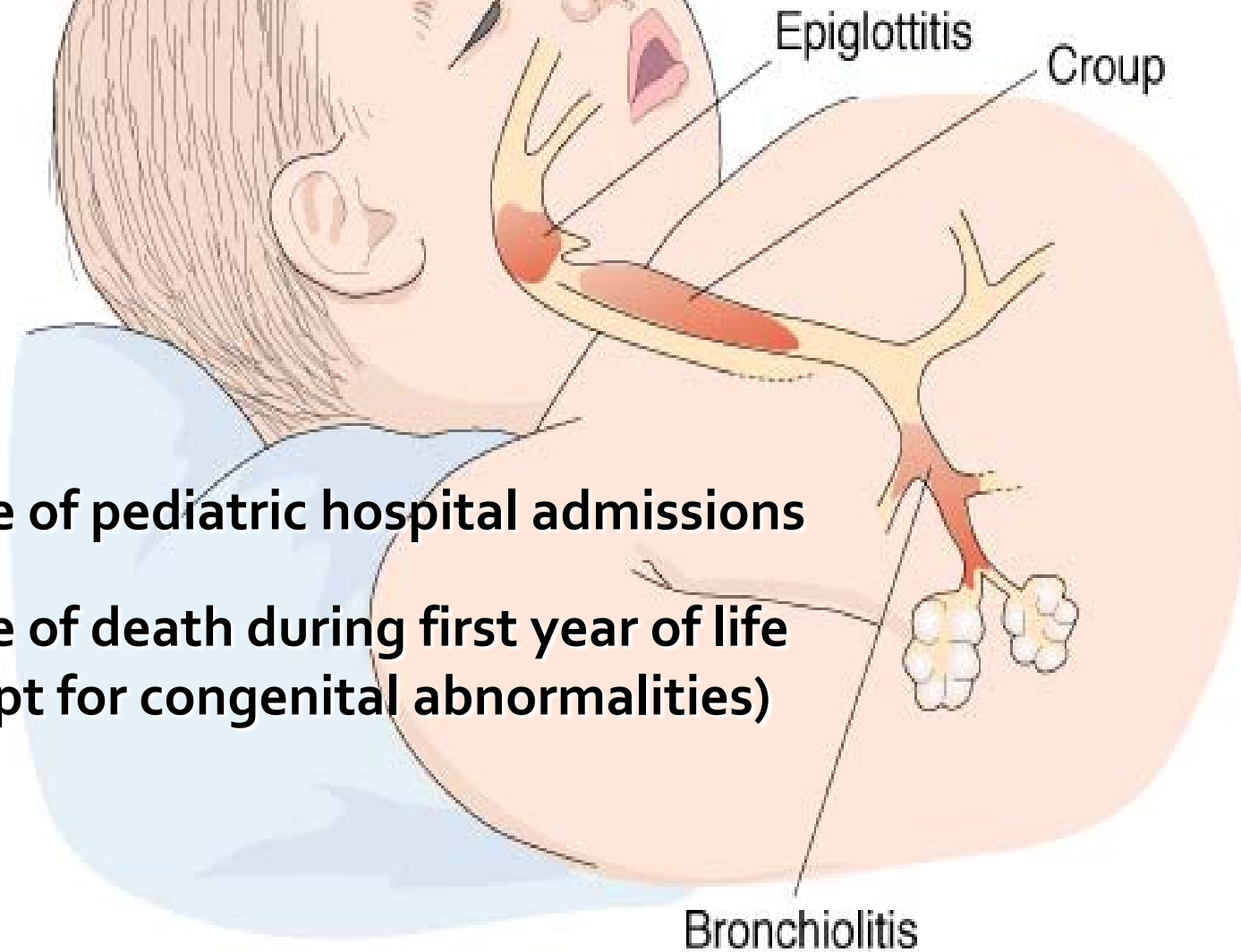
- List and treat some respiratory emergencies that children suffer from
 - Croup
 - Epiglottitis
 - Foreign Body Aspiration
 - Asthma
 - Bronchiolitis



Respiratory Emergencies



Respiratory Emergencies



#1 cause of pediatric hospital admissions

**#1 cause of death during first year of life
(except for congenital abnormalities)**

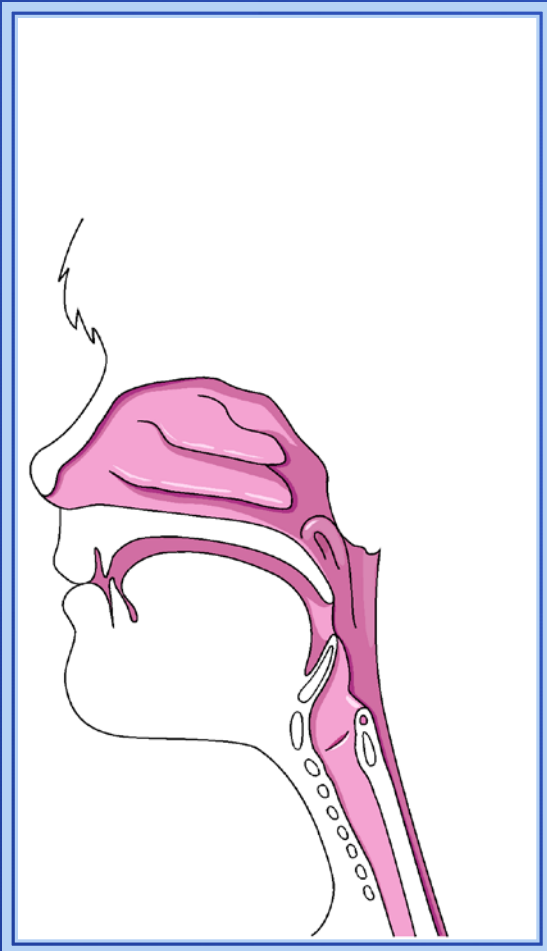
Respiratory Emergencies

**Respiratory failure
can progress quickly to respiratory arrest and then to
cardiac arrest**

Respiratory Emergencies

**Prompt recognition & Effective management of
Respiratory Distress
can prevent deterioration in to cardiac arrest &
improve outcome**

Pediatric Respiratory System



- Large head, small mandible, small neck
- Large, posteriorly-placed tongue
- High glottic opening
- Small airways
- Presence of tonsils, adenoids

Pediatric Respiratory System

- Poor accessory muscle development
- Less rigid thoracic cage
- Horizontal ribs, primarily diaphragm breathers
- Increased metabolic rate, increased O₂ consumption

Pediatric Respiratory System

**Decrease respiratory reserve
+ Increased O₂ demand =
Increased respiratory failure risk**

Respiratory Distress

Signs of Hypoxia

- Tachypnea/Bradypnea (late)
- Tachycardia/ Bradycardia (late)
- Palor
- Nasal flaring/ Retractions/
Abdominal breathing
- Grunting
- Fatigue
- Cyanosis (late)
- Agitation/AMS (late)



Respiratory Distress

Figure 6: Respiratory Distress

Signs of respiratory distress include tripod position, nasal flaring, retractions

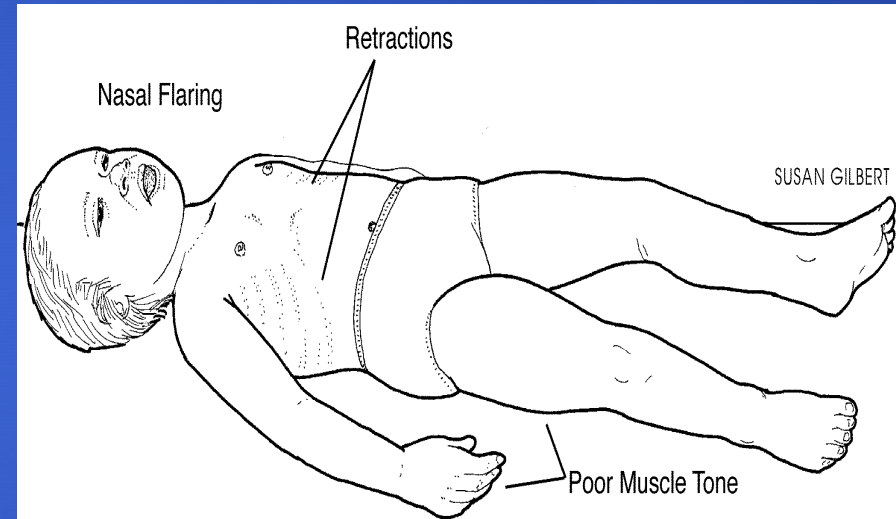
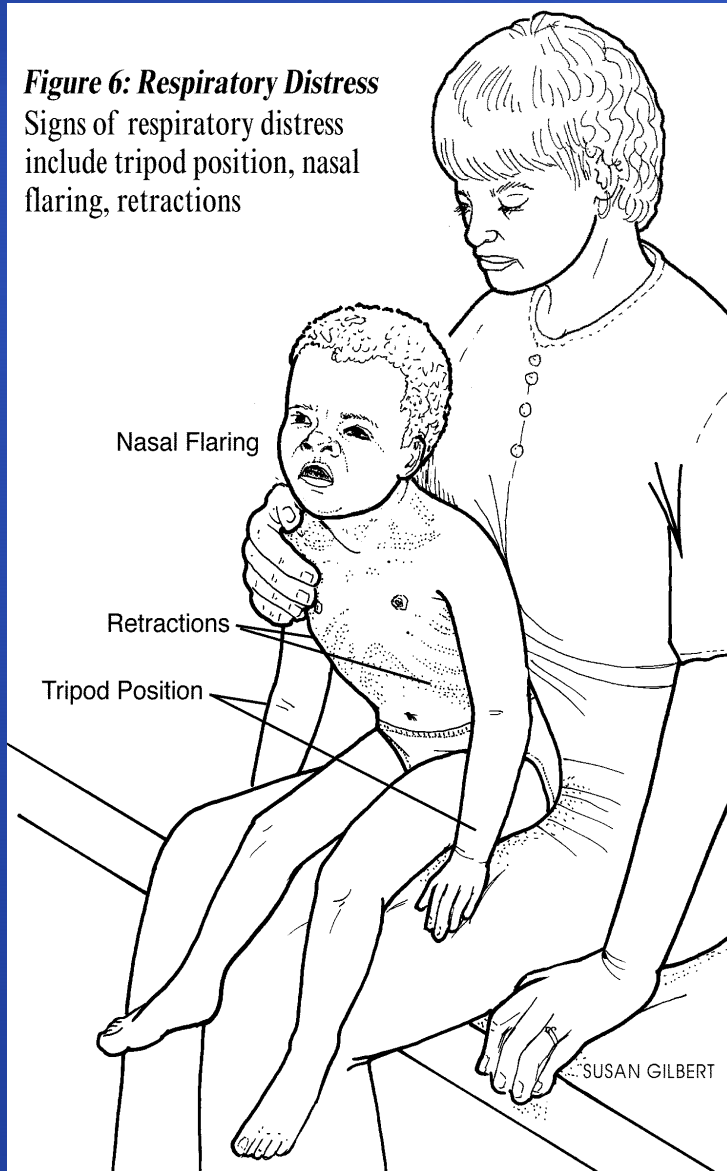
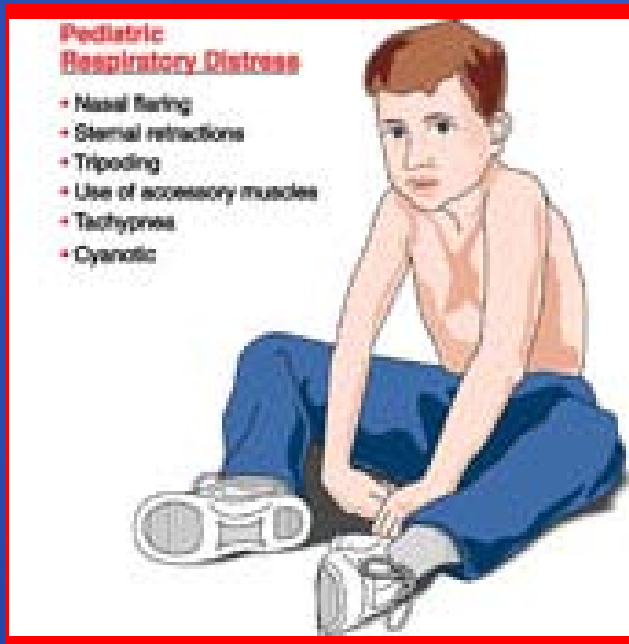


Figure 4: Child, Poor First Impression

Sick child with poor muscle tone, nasal flaring, retractions

Respiratory Distress



Causes

Upper Airway Obstruction
Lower Airway Obstruction
Parenchymal Disease
Disordered Control of Breathing



Respiratory Emergencies

- **Upper Airway Obstruction**

- Croup
- Epiglottitis
- Foreign Body Aspiration
- Anaphylaxis
- Peritonsillar or retropharyngeal abscess

- **Lower Airway Obstruction**

- Asthma
- Bronchiolitis

- **Lung Tissue Disease**

- Pneumonia
- Pulm Edema
 - CHF
 - ARDS
 - Sepsis
 - Pulm Contusions

- **Disordered Control of Breathing**

- Neurologic Disorders



Laryngotracheobronchitis



Croup

Croup: Incidence

- 3 months to 6 years
 - Mean is 18 months
- Males > Females
- Fall, Early winter
- Most common form of airway obstruction or stridor in 6mo-6yrs



Croup: Pathophysiology



- Viral infection (parainfluenza)
- Affects larynx, trachea
- Subglottic edema; Air flow obstruction



Croup: Signs/Symptoms

- “Cold” symptoms-1-5 day prodrome with cough/coryza
- Low grade fever
- Non toxic
- No drooling
- Stridor (increases with agitation)
- “Barking” cough
- Hoarse voice
- Wheezing/crackles
- Symptoms increase at night

Croup

Steeple Sign

- Subglottic narrowing



Croup



Mild

- Occasional barking cough
- No stridor
- No retractions

Croup

Moderate

- **Stridor at rest**
- **Retractions**
- Good distal air entry
- No Agitation

Severe

- Stridor at rest
- Retractions
- **Diminished Air Entry**
- **Agitation**

Impending Respiratory Failure

- Poor Air Movement
- Lethargy/Decreased LOC
- Dusky skin
- Decreased O₂ sat

Mild Croup

- Reassurance
- Cool Mist
- Hydration
- Fever Control
- Consider a single dose of Dexamethasone





Croup: Management

Severe Croup

- Humidified high concentration oxygen
- **Nebulized Racemic Epi**
 - 2.25% Solution
 - 0.05 ml/kg (max 0.5 ml)
 - Observe 2 hours for rebound
- **Dexamethasone** (po/ iv/im)
 - 0.6mg/kg
- Consider **Heliox**

Impending Resp Failure

- High Flow O₂
- Assist Ventilations
- Anticipate the need for ETT
- Prepare for a surgical Airway

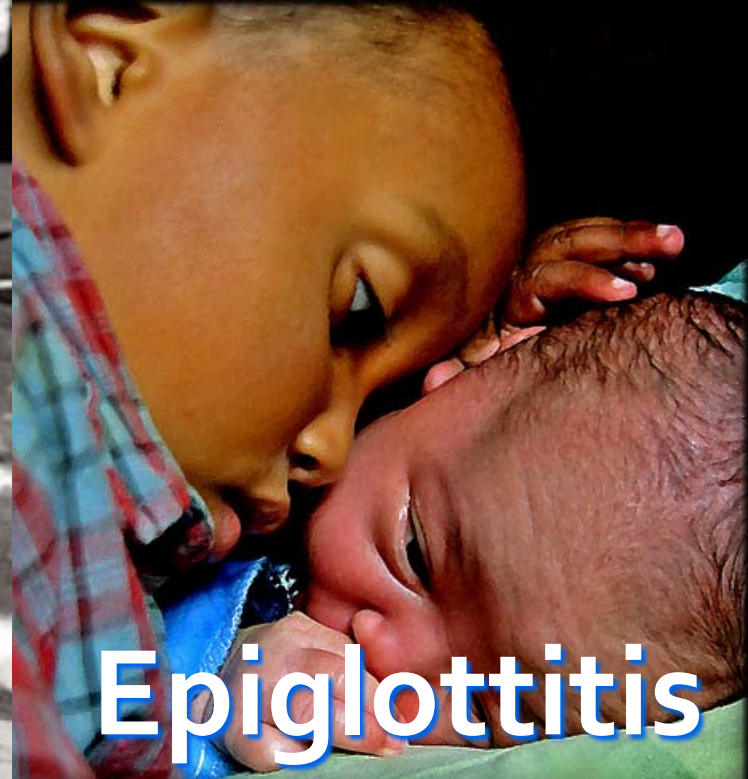
The good news

- With aggressive ED treatment most patients with croup do not require admission

Croup Admissions

Factors that increase the likelihood of admission

- Poor response to initial treatment
- Stridor at rest
- Inadequate fluid intake
- Re-presentation to the ED within 24 hours
- Age less than 6 months
- Hx of severe obstruction before presentation
- Hx of previous severe croup
- Known structural airway anomaly (eg, subglottic stenosis)
- Uncertain diagnosis
- Social Issues- parental anxiety/transport issues



Epiglottitis: Pathophysiology

- Bacterial infection (H.flu, staph, strep)
- Affects epiglottis, adjacent pharyngeal tissue
- Supraglottitis

Complete Airway
Obstruction



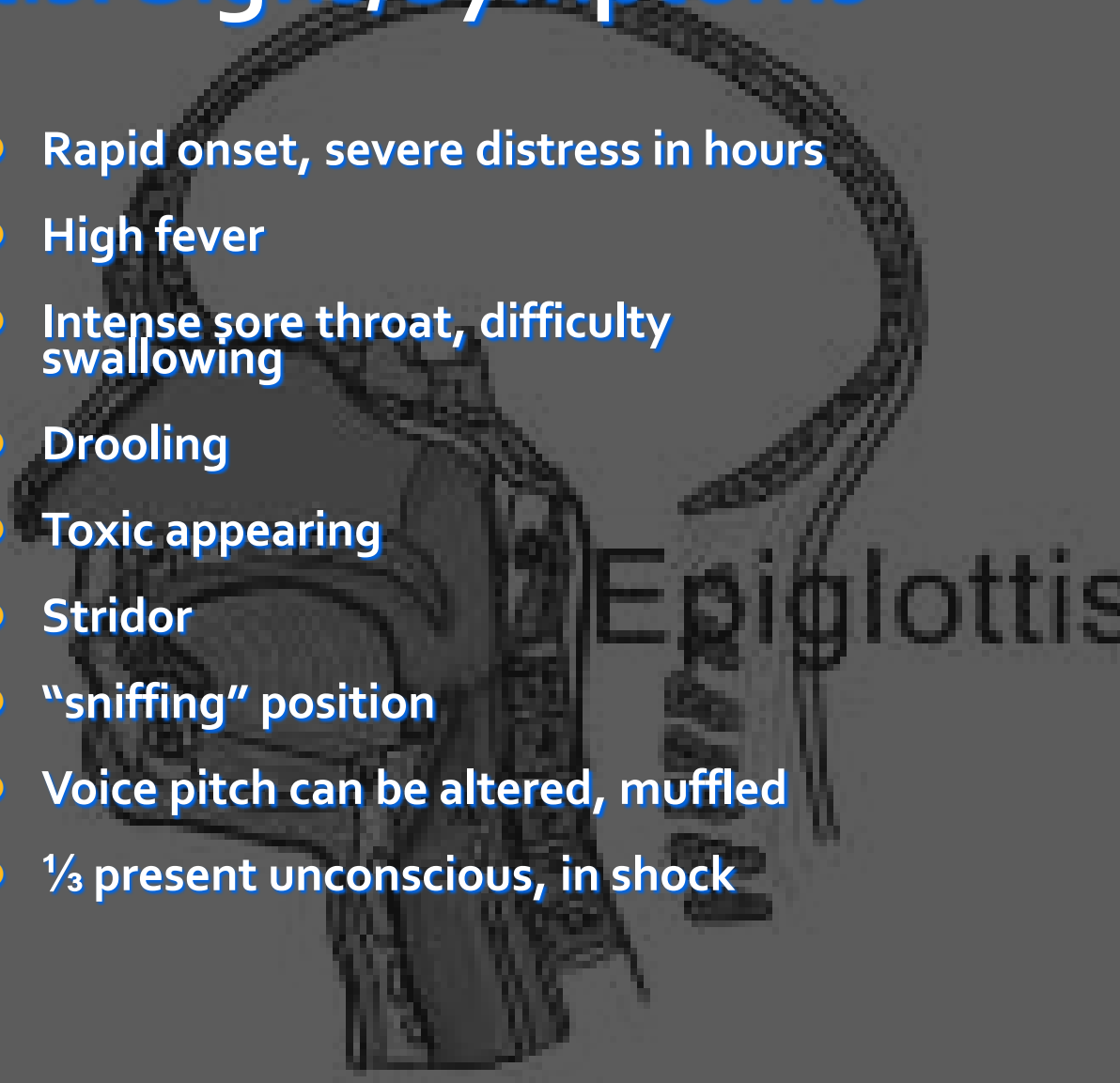


Epiglottitis: Incidence

- Children 2-7 years old (most >4)
- Peds incidence falling due to HiB vaccination
- Now more common in adults than children



Epiglottitis: Signs/Symptoms

- Rapid onset, severe distress in hours
 - High fever
 - Intense sore throat, difficulty swallowing
 - Drooling
 - Toxic appearing
 - Stridor
 - “sniffing” position
 - Voice pitch can be altered, muffled
 - $\frac{1}{3}$ present unconscious, in shock
- 

Epiglottitis



**Respiratory
distress+ Sore
throat+ Drooling
=
Epiglottitis**

Thumb Print



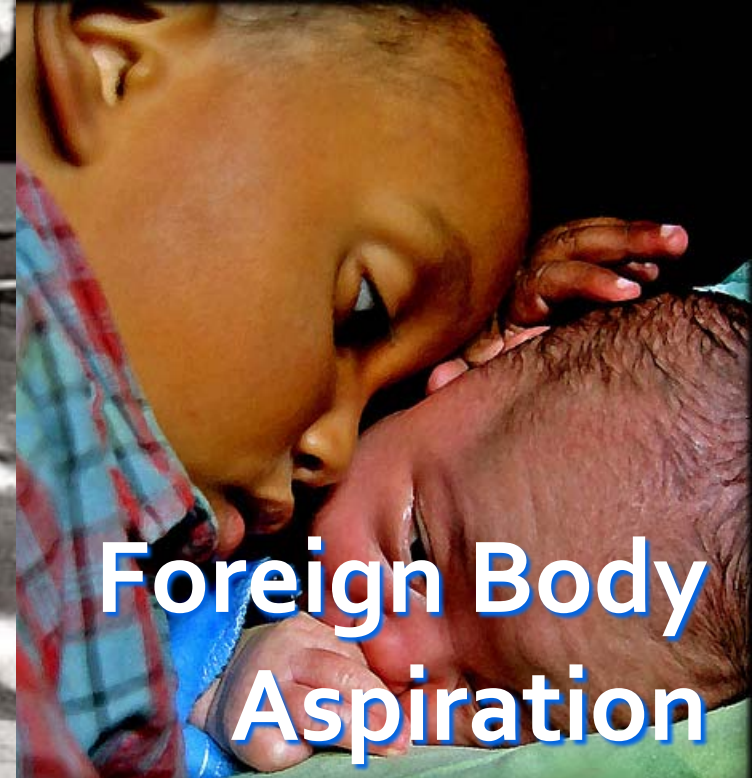


Epiglottitis: Management

- High concentration oxygen
- IV Access
- Do not attempt to visualize airway in the ED
- Laryngoscopy- ENT/Anesthesia consultation
- IV 2nd/3rd Gen Cephalosporin

Epiglottitis

- Mild swelling on laryngoscopy
 - Close ICU observation
- If Signs/Symptoms of Airway Compromise
 - ETT-preferably in the OR
- If resp failure/obstruction
 - immediate ETT
 - Emergent cricothyrotomy
 - Needle jet insufflation



Foreign Body Aspiration

- Peak at 1-3 years
- 90% < 4 years
- Food and toys

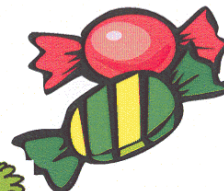


Choking Hazards

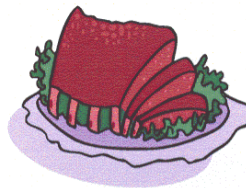
Round



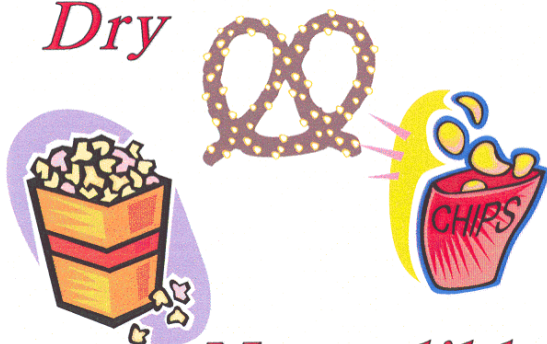
Hard



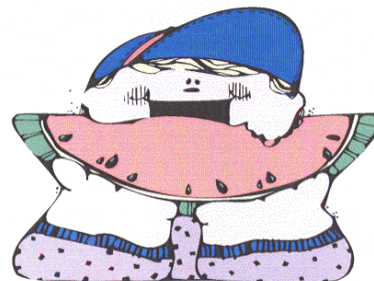
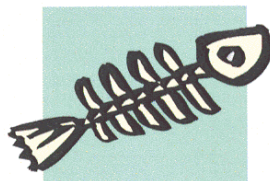
Tough



Dry



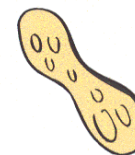
*Non-edible
parts*



Sticky



Slippery



FB Aspiration

Suspect in any previously well, afebrile child with sudden onset of:

- Tachypnea/ Respiratory distress
- Choking/Gagging
- Coughing
- Stridor
- Wheezing
- Hoarseness
- Diminished Breath Sounds (distal to obstruction) on affected side
- Hyperresonance (hyperinflation) or dullness to percussion (atelectasis)
- Blood streaked sputum



CXR Findings

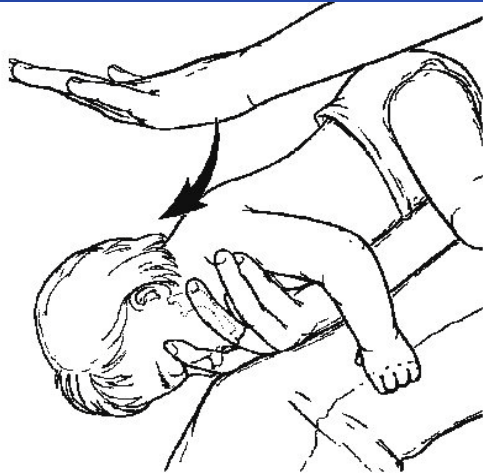
- Normal (25%)
- Radiopaque FB
- Localized Hyperinflation
- Atelectasis
- Mediastinal Shift
- Pneumonia

Management

Mild-Moderate Symptoms

- Minimize intervention if child is conscious and maintaining own airway, avoid agitation
- 100% oxygen as tolerated
- Wheezing
 - Object in small airway
 - Avoid trying to dislodge in field

Severe Symptoms



Initial treatment for
a choking baby



Abdominal Thrust
for a child

If conscious...

- Inadequate ventilation
 - Infant: 5 back blows/5 chest thrusts
 - Child: 6-10 Abdominal thrusts (Heimlich maneuver)



If unconscious

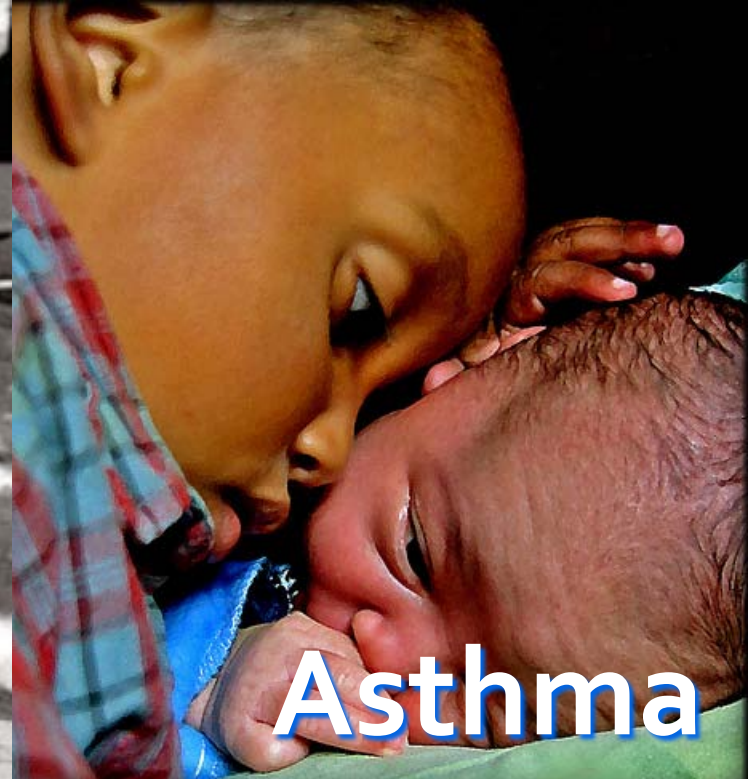
- Jaw thrust/ head tilt-chin lift
- Look in the mouth, remove visible FB
- BVM
- If you cannot provide adequate ventilation
 - move on to chest compressions & attempt ventilation (even if pulse is present)
 - Before you give each breath look for FB, sometimes chest compressions can help displace object
- Attempt ETT
- Definitive Treatment- ENT/Anesthesia

Remove the object with your
finger ONLY if you can see it



Foreign Bodies

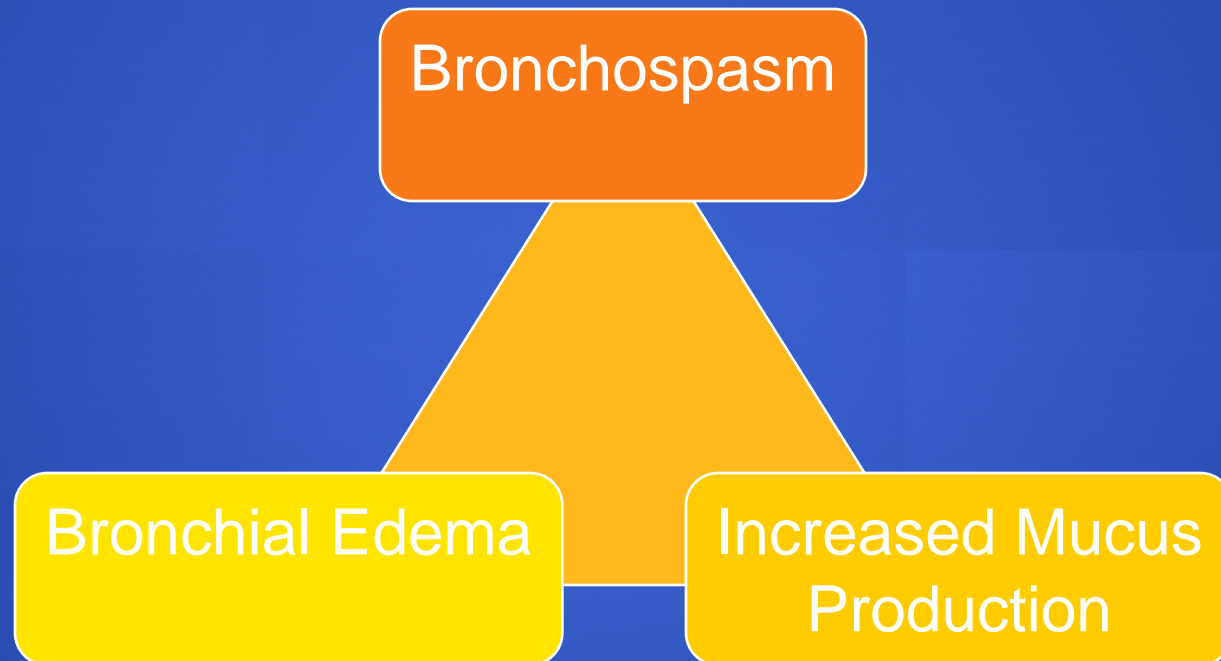
Do NOT perform **BLIND**
oropharyngeal finger sweeps!



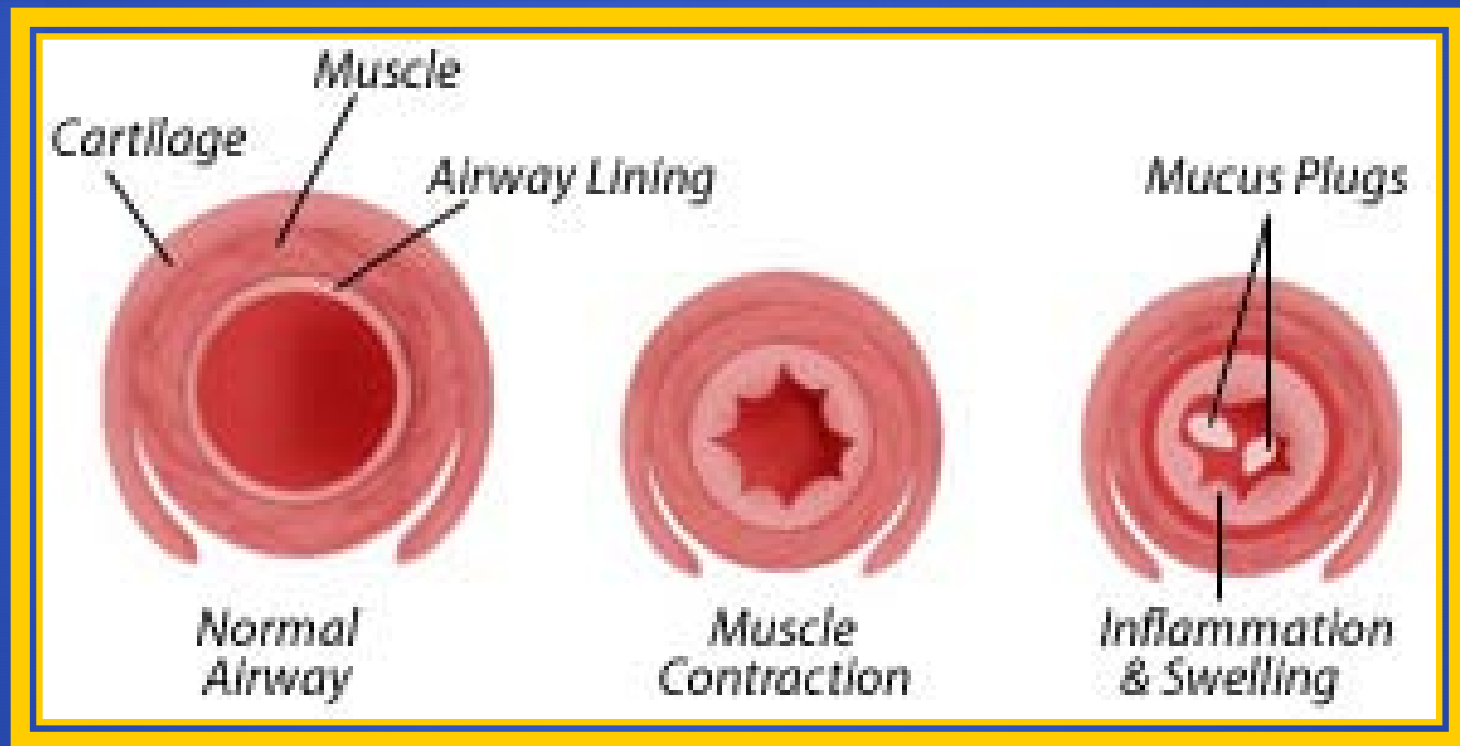
Asthma Pathophysiology

- Lower airway hypersensitivity to:
 - Allergies
 - Infection
 - Irritants
 - Emotional stress
 - Cold
 - Exercise

Asthma: Pathophysiology



Asthma: Pathophysiology



Asthma: Pathophysiology



Cast of airway
produced by asthmatic
mucus plugs

Asthma: Signs/Symptoms

- Coughing
- Expiratory wheezing
- Tachypnea
- Dyspnea



Asthma: Signs/Symptoms



- Signs of respiratory distress
 - Nasal flaring
 - Accessory muscle use
 - Tracheal tugging
 - Suprasternal, intercostal, epigastric retractions
 - Paradoxical thoraco- abdominal movement
 - ALOC (agitated, drowsy, confused)
 - Cyanosis

Asthma

**Silent Chest equals
Danger**

Asthma: History

- How long has patient been wheezing?
- How much fluid has patient had?
- Recent respiratory tract infection?
- Medications? When? How much?
- Allergies?
- Previous hospitalizations?

Asthma: Physical Exam

- Patient position?
- Drowsy or stuporous?
- Signs/symptoms of dehydration?
- Chest movement?
- Quality of breath sounds?

Risk Factors Associated with Asthma Deaths

- Prior ICU admissions
- Prior intubation
- >3 emergency department visits in past year
- >2 hospital admissions in past year
- >1 bronchodilator canister used in past month
- Use of bronchodilators > every 4 hours
- Chronic use of steroids
- Progressive symptoms in spite of aggressive Rx

Status Asthmaticus

Asthma attack
unresponsive
to B₂ adrenergic agents

Asthma: Management

- Airway
- Breathing
 - Sitting position
 - Humidified O₂ by NRB mask
 - Dry O₂ dries mucus, worsens plugs
 - Encourage coughing
 - Consider intubation, assisted ventilation

Asthma: Management

- Circulation
 - IV
 - Assess for dehydration- IV Fluids
 - Cardiac monitor

Mild Asthma

- High flow O₂
- Bronchodilators
 - Albuterol inhaler/nebulizer
- Steroids- PO



Severe Asthma

- **Nebulized Bronchodilators**
 - Albuterol- b2 agonist- 0.5 mg/kg/hour
 - Ipratropium- anticholinergic- 0.5 mg every 4-6 hours
- **Steroids**
 - Prednisolone - 1-2 mg/kg/day PO
 - Solumedrol - 4 mg/kg/day IV/ IM
- **Magnesium (IV)**
 - 25-100 mg/kg IV over 20 mins



Severe Asthma

- Subcutaneous Beta agents
 - Terbutaline
 - 0.01 mg/kg q 15-20 mins (max 0.25 mg) SQ
 - Epinephrine 1:1000
 - 0.01 mg/kg q 15-20 mins (max 0.3 mg SQ)

**POSSIBLE BENEFIT IN PATIENTS
WITH VENTILATORY FAILURE**



Severe Asthma

- Other treatment options
 - Heliox (mixture of O₂ + Helium)
 - Halothane
 - Nebulized Lasix
 - IV Leukotriene modifiers



Impending Respiratory Failure

- Consider BiPAP
- Prepare for Intubation
 - Ketamine
 - has bronchodilator properties
 - 1-2 mg/kg IV
 - Consider a cuffed tube

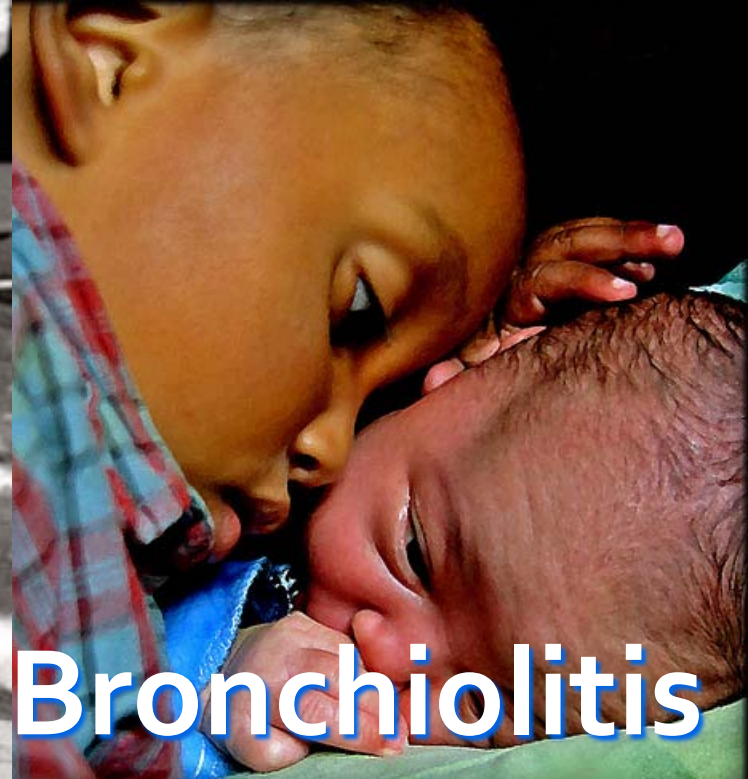
Admission Criteria

- Needs O₂ supplementation
- Refractory Asthma- A child who does not respond after 2 hours of continuous treatment
- PF <50% of predicted
- PF 50-70% with social issues
- PaCO₂ >40

Consider other causes....

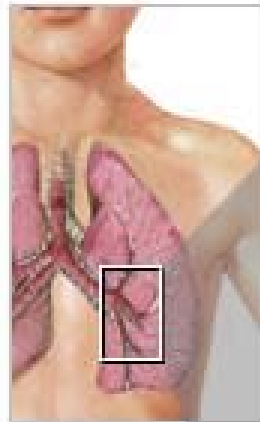
ALL THAT WHEEZES IS NOT ASTHMA

- Pulmonary edema
- Allergic reactions
- Pneumonia
- Foreign body aspiration
- Bronchiolitis

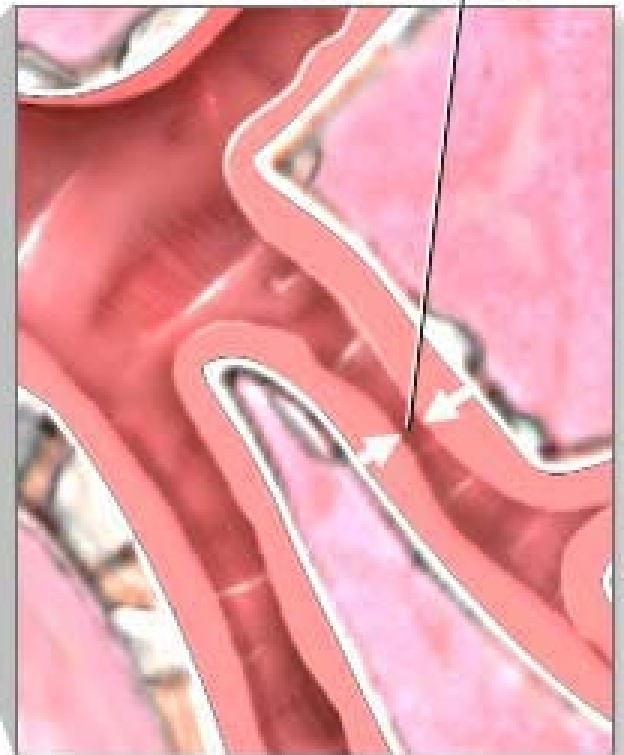


Bronchiolitis: Pathophysiology

- Viral infection
 - RSV (50-70%)
 - Others
 - Parainfluenza, rhinovirus, adenovirus, influenza
- Inflammatory bronchiolar edema
- Air trapping



Bronchial swelling



In bronchiolitis, the airway becomes obstructed from swelling of the bronchiole walls

Bronchiolitis: Incidence

- Children < 2 years old
- 80% of patients < 1 year old
- October – May
- **Extremely contagious**



Bronchiolitis: Signs/Symptoms

- Coughing, nasal/eye drainage, fevers
- Wheezing
- Poor feeding
- Can progress to severe respiratory distress
- Extreme tachypnea (60 - 100+/min)
- Retractions, Cyanosis



Which one is it?

Distinguishing between Bronchiolitis and Asthma in the wheezing infant can be difficult

Asthma vs Bronchiolitis

- Asthma

- Age - > 2 years
- Temperature - usually normal
- Family Hx - common
- Hx of allergies - common
- Response to Epi - positive

- Bronchiolitis

- Age - < 1-2 years
- Fever is common
- Family Hx - negative
- Hx of allergies - negative
- Response to Epi - negative



Bronchiolitis: Management

- Humidified oxygen by NRB mask
- Cardiac Monitor
- IV Hydration
- Oral/Nasal Suctioning prn
- +/- Bronchodilators
- +/- Racemic Epinephrine- then 4 hour observation
- Anticipate need to intubate, assist ventilations

Bronchiolitis Management

- Randomized controlled trials have shown **mixed results** with bronchodilators and steroids
- **Consider a trial of bronchodilators if the diagnosis is unclear**
 - **There is little downside**
- Some infants respond to Nebulized Epi or Albuterol, while others have worsening of their symptoms

Risk of Apnea

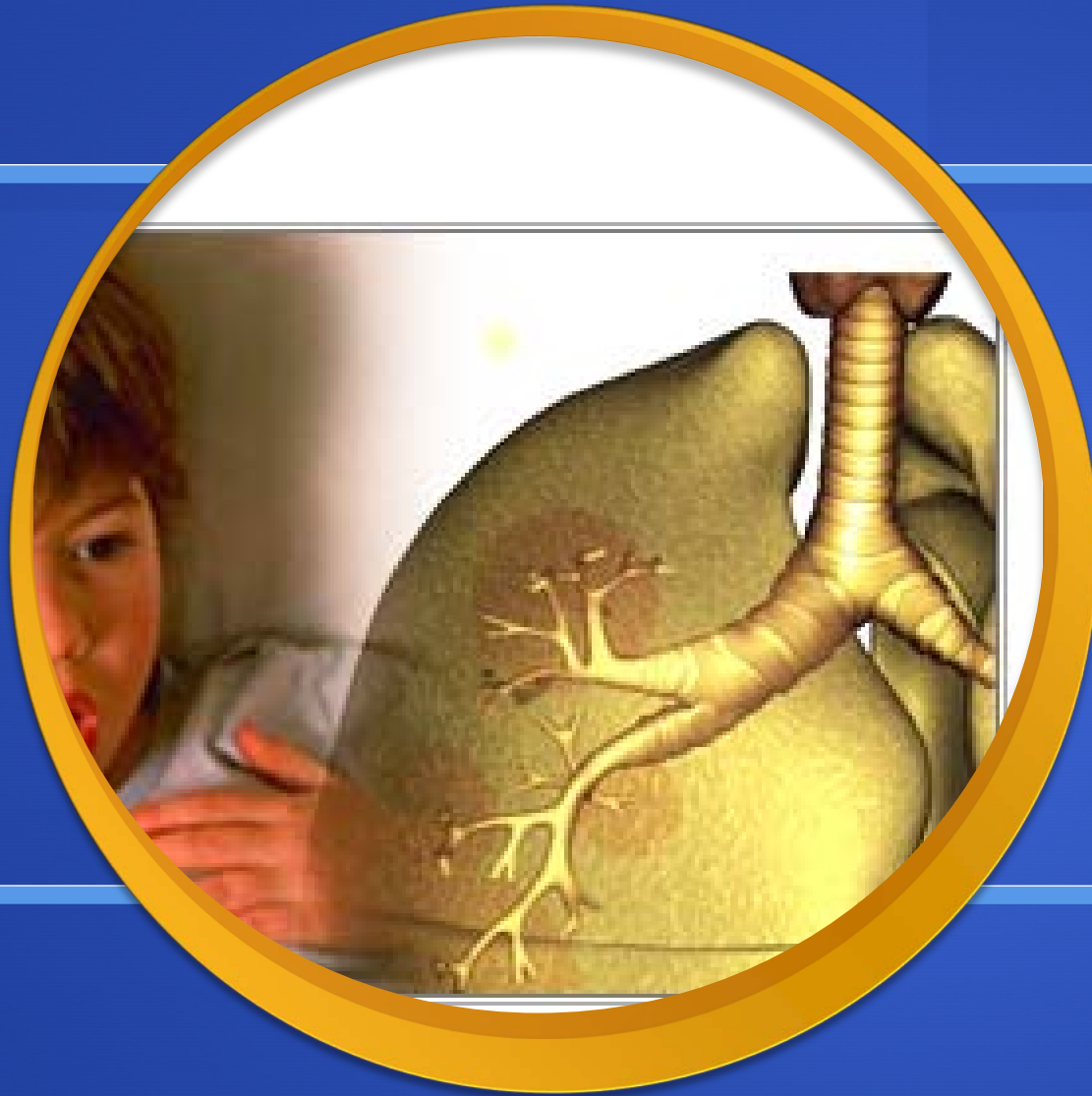
- <6 weeks of age
- h/o prematurity
- Apnea of prematurity
- Low o2 sat on admission



Bronchiolitis Admissions

- Age < 4-6 weeks (& early in the disease process)
- Moderate to Severe distress (retractions)
- h/o Apneic spells
- Dehydration
- Sustained RR>60-70/min
- O₂ sat<92-94%
- Underling Chronic Disease-h/o BPD, Cg Heart Disease, & Immunocompromised
- Social Issues





Initial Management of Respiratory Distress

1^o Assessment

Airway

- Support Airway
 - Let child assume position of comfort
 - Open airway (manual maneuvers)
- Clear Airway
 - Suction, remove, visualized FB
- Insert OPA/NPA
- Is it maintainable?

Breathing

- Assess RR, Effort, Tidal Volume, Breath sounds
- Monitor O₂ sat
- Assist Ventilation (BVM)
- Provide O₂ (humidified)
- Prepare for ETT
- Medicate

1° Assessment

Circulation

- Monitor heart rate, Color, Temp, BP, Cap Refill
- Monitor Organ Perfusion
 - Mental Status
 - Palor, mottling, cyanosis
 - Urine Output

Disability

- Pupils
- GCS
- AVPU- Pediatric Response Score

Exposure

- Undress

2^o Assessment

Focused H & P



SAMPLE

- Signs/Symptoms
- Allergies
- Meds
- Past Med Hx
- Last Meal
- Events

3^o Assessment

Ancillary Studies



- Labs
 - CBC, Blood Cultures
 - ABG
- Radiographs
 - CXR
 - Lateral Neck
 - Decub Films

Respiratory Emergencies

- Then use specific goal directed therapy as mentioned for the causes identified





My Pride and Joy

